

OCT 14 1944

VOLUME LIV

SEPTEMBER, 1944

NUMBER 9

Medical Library

THE LARYNGOSCOPE

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PUBLISHED BY

THE LARYNGOSCOPE

640 SOUTH KINGSHIGHWAY

ST. LOUIS (10), MO., U. S. A.

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THE LARYNGOSCOPE.

VOL. LIV

SEPTEMBER, 1944.

No. 9

EXPERIENCES IN SURGERY OF THE FACIAL NERVE.*†

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Los Angeles.

One of the most useful functions man has in common with his fellowman is the play of emotional expression as revealed on the features of his face. To be deprived of this subtle emotional language is to be robbed of one of the greatest joys of social contact; more than that, it is to be denied functions essential to a normal psychic balance, with all its resultant social and economic implications.

With these handicaps in mind, the question of facial nerve repair takes on a multiple significance. Not only as to appearance, but perhaps even more in the matter of function does the surgeon's skill play a vital rôle. What can be done to restore symmetry of contour of physiognomy is valuable indeed, but unless the restoration of emotional functions is at least the *goal* of surgical endeavors, the major factor in this cruel deformity remains.

It has not been my purpose or function to relate minute details of pathology, histology or techniques used in facial nerve repair, but rather to generalize broadly the impressions and conclusions gained from personal experience and from that of other writers on the subject.

*Read at the Seventy-seventh Annual Meeting of the American Otological Society, New York, June 6, 1944.

†From the Department of Otolaryngology of the University of Southern California School of Medicine.

Editor's Note: This ms. received in Laryngoscope Office and accepted for publication, July 1, 1944.

The first attempt to treat facial paralysis apparently was made in 1879, when Drobnik anastomosed the spinal accessory to the facial nerve with reported improvement in symmetry. In succeeding years similar operations by many others employing anastomosis of facial nerve with adjacent nerves were performed with varying results. To the late Sir Charles Ballance, of London, and the late Arthur B. Duel, of New York, is due much of the credit for early fundamental work.

Many attempts had been made through the years preceding 1927 to perform intratemporal repair of the facial nerve, but it was not until that year that Bunnell¹ performed the first successful end-to-end anastomosis; a procedure which produced emotional facial expression naturally. This technique was considered immeasurably superior to the earlier method of using adjacent nerves; Ballance and Duel also reached the same conclusion following much experimental work along these lines. Bunnell also originated and later put into successful practice the use of a graft to join the distal and proximal ends of the affected nerve, using a short free graft from the sural nerve of the leg for this purpose. These methods of direct suture and nerve transplantation as developed through the years have been found to restore the greatest degree of expressional movements to the face.

It is to be noted here that Martin,² in 1931, reported a successful end-to-end anastomosis of the facial nerve, with approximately complete recovery of function; this case had been reported previously at the Pacific Coast Oto-Ophthalmological Society in Victoria, in 1930, while Ballance and Duel, who had been doing extensive research work along these lines, did not report their results until 1932-1934.

Two phases of facial nerve repair suggest themselves for discussion: 1. Indications for Operation; 2. Time and Technique of Operation.

The desirability of surgical repair should be measured by the degree of improvement which may be attained over the *original condition*, rather than by failure to realize *complete* restoration of *function*. All will agree, including the patient, that any degree of symmetry of function which may be achieved through surgical measures is better than an existing lesser degree of absence of function.

Whether the paralysis is due to: 1. inflammation or edema; 2. direct injury such as damage to the nerve without severance; or 3. actual severance of the nerve, cannot be foretold on clinical examination; only on exploration of the individual patient can the pathology be determined. Generally speaking, therefore, it would seem advisable to explore and determine the possibility of restorative measures. Uncertainty may also attach to the fact that, as in the writer's own experience, the original operator frequently has not been aware of—or has not been prone to admit—severance of the nerve during the operative procedure. Fortunately, the incidence of this accident is believed to be rapidly diminishing, due to improved training of operators and to the use of new therapeutic measures which have served materially to lessen the frequency of surgical mastoiditis.

The faradic test has been rather widely used as a guide to the desirability of surgical procedure, the contention being that a negative response calls for exploration and attempted repair. Ballance and Duel² seemed to be fixed in their belief that exploration is generally a safer procedure in uncertain cases. Kettel⁴ favors explorative decompression in all cases of complete facial paralysis occurring in immediate connection with simple mastoideectomy and considers the prognosis in such cases, under conservative treatment, so grave that intratemporal intervention is absolutely indicated. He quotes Ballance and Duel in their statement that delay is not justified, but admits the possibility of waiting the 72 hours, proposed by Tickle,⁵ after the onset of palsy as the limit of time before intervening surgically if the faradic response is lost after that brief delay.

Abnormal movements of the facial musculature are frequently observed following recovery from traumatic lesions of the facial nerve and occasionally follow facial paralysis of toxic origin. These tic-like movements have been thought by some to be central in origin and by others to be peripheral. Even the co-writers, Ballance and Duel, disagreed as to their etiology. Fowler,⁶ however, states that they are not central but are characteristic of a peripheral nerve injury, and that wherever observed, one may be sure there has been trauma or severe toxic disturbance of the nerve trunk. He urges earliest possible relief of peripheral nerve palsy to fore-

still serious damage to the nerve and consequent abnormal movements.

While the negative response to the faradic test fails to tell us what we desire to know and exploration might consequently seem the logical course, in my personal experience, several cases reacting negatively to this test have recovered spontaneously. It must be recognized that in a good many instances of acute diseases of the middle ear a spontaneous recovery may well be anticipated following careful treatment of the offending aural condition.

A typical instance of ultimate spontaneous recovery in the face of negative faradic response is the following case:

I. R., a young woman, 26 years of age, first came under my observation in April, 1941, with a bilateral Bell's palsy of sudden onset. The patient was seen daily as a check on the faradic response, which decreased until the sixth day, when no response could be elicited. Bilateral decompression was then considered, but was refused by the patient. Examinations were continued for a period of one month, during which time supportive treatment including physiotherapy, vitamins and massage was administered. Two months following the onset, faradic response was observed to be returning on both sides of the face, with ultimate complete recovery. This case is presented in support of the belief that in certain cases with negative faradic response, in which explorative surgery might otherwise seem indicated, one may be justified in expecting a spontaneous return of function.

My experience would lead me to the following generalizations with regard to the justifiability of surgery of the facial nerve: In acute infection of the mastoid, with facial nerve involvement, decision for surgery is primarily governed by the prerequisite of the *mastoid infection*, with a good chance of spontaneous recovery following mastoidectomy. In chronic involvement of the mastoid, with presence of facial paralysis, *the nerve involvement* is the prime indication for surgery. McCaskey⁷ states that in his experience nonsurgical treatment, including physical therapy and manipulation, is best suited to paralysis due to systemic disease. It thus becomes a question for the judgment of the surgeon as to which cases of facial nerve paralysis surgery would best serve, and which may be expected to recover spontaneously.

As to when to operate, the consensus of opinion of writers on the subject of facial paralysis points conclusively to the advantage of early exploration and repair, where there is

evidence that spontaneous recovery is unlikely. Ballance and Duel,² state unequivocally: "The accepted time is now; no delay is justified." A minimum of damage to the nerve and a better muscle tone are advantages to both patient and surgeon in the favor of early operation. My experience, however, confirms my belief that even in cases of long-standing, hope of benefit from surgery should not be abandoned. McCall and Gardiner,³ with many others, believe the criterion for operation in cases of long-standing is the reaction to galvanic stimulation. They say, "A positive galvanic response is indication for operation; a negative response means muscle degeneration"—and they conclude that it is useless to attempt to repair the nerve under the latter circumstances. A successful nerve transplantation 14 years after development of paralysis is reported by Sullivan,⁴ with the statement that the muscles need not have degenerated even after this length of time, and that the galvanic response, therefore, may still be present. The oldest case recorded seems to be one of 22 years' standing, though this record is not available.

Three general methods of surgical treatment of facial paralysis have been employed: 1. Decompression of the nerve, for relieving pressure caused by edema, hemorrhage, bone spicule, etc., which pressure in time may cause degeneration of the nerve; it has been my experience that following simple decompression, recovery frequently has been rapid. 2. Repair of the severed nerve by end-to-end anastomosis, where the damage or gap is brief. 3. Nerve transplantation where the breech is too extensive for direct suture. The "rerouting" method, as described by Bunnell,¹⁰ of lifting the nerve out of its canal to shorten its course and suturing the proximal to the distal segment, has been recorded with optimism as to its possibilities, and by some has been considered superior to nerve transplantation. General surgical opinion today, however, points to its being superseded by the autoplastic graft as a preferred method of bridging the nerve gap, since the trauma resulting from this radical procedure is believed likely to detract from good results.

It has been demonstrated that the employment of finer nerves where utilized for the graft have produced more rapid and complete recovery than larger nerves, due to the easier nourishment of the whole caliber from the fluids in which

they are bathed. Thus it is probable that two or three grafts used together, side by side, or as a "cable," while only about the diameter of a larger one, actually permit a greater number of active neurons to pass through to the distal segment to make final connection with the muscle fibres.

The living autoplastic nerve graft immediately after its removal is the present-day choice of operators; and experiments seem to show that any nerve, sensory or motor, will do for the purpose, as long as the graft is of suitable size to lie in the Fallopian canal. My personal experience, however, has been in agreement with Tickle,⁵ that the external femoral cutaneous nerve is the most accessible and desirable for this purpose. Current literature indicates that the use of frozen fresh graft is being advocated by army surgeons, and this development will be followed with much interest.

The length of the graft has been found to bear some relation to the time of recovery — the shorter the graft the quicker the regeneration. Age has also been recognized as a factor in rapidity of repair, the advantage naturally being with youth. As stated by McCaskey⁶, it is generally considered that the degree of regeneration to be obtained in nerve repair is in direct proportion to the accuracy of the union of the nerve ends. He stresses the importance of meticulous technique and the aseptic surgical repair of the nerve by suture in a clean field, as against operation in the presence of infection and free blood, with open drainage and merely laying the nerve ends together. While recognizing the desirability of a field free from suppuration, I have found that my results are about equally favorable whether infection is present or absent. This experience is supported by Martin,¹¹ who states that while he previously contended that operation should be delayed until the field was entirely free of infection, and while he still favors this condition, his results were equally good in four cases reported by him in 1940, in two of which the fields were clean and in two were infected.

In this connection it is interesting to note the progress in the use of blood fluids instead of suture to maintain the graft in place. In 1940, Young and Medawar¹² introduced the technique of using concentrated coagulated blood plasma as an adhesive to unite the nerve stumps. This method has been confirmed by Sullivan,¹³ who states his preference for blood

plasma as against suture, because neurofibril growth is apt to be interrupted by the presence of suture. Among the by-products of human serum albumin which promise to be of great value in supplanting suture are thrombin and fibrinogen, employed as hemostatic and adhesive agents. One of these recent developments is fibrinfoam sponge, a product being favorably considered by army surgeons. Unlike surgical sponges, they do not have to be removed following the operation, as they are eventually absorbed. Michael and Abbott¹⁴ report encouraging results from the use of fibrinogen in this capacity in neurosurgical repair work.

My experience that the frontalis muscle function rarely returns in a case of severed nerve, though the other branches may attain normalcy, is supported by Martin.¹¹ In the four cases reported by him, one did show return of function of the superior branch, which he attributed to end-to-end anastomosis and an early operation. Only one out of 11 of my cases with severance of the facial nerve obtained definite functional return of the superior branch, and this also was an end-to-end anastomosis performed soon after injury in a very young child.

The following scant outlines of case histories may prove of some interest in revealing the course of surgical repair in a few patients who have come under my observation. In each case the usual postoperative galvanic treatment and physiotherapy were administered over as long a period as was practicable. For the sake of brevity, these records have been abbreviated to illustrate only the salient points mentioned.

REROUTING.

W. P., age 14, had facial nerve severed in 1928, by a bullet traversing from right mastoid with exit through left upper maxilla. Just previous to mastoidectomy in July, 1934, both faradic and galvanic responses were negative. The rerouting technique described by Bunnell was followed. This was a clean field. Some questionable improvement in function was noted following the operation, but the result was not satisfactory. The patient later had plastic operations, but as far as the nerve regeneration is concerned, there is no definite improvement at the present time, and the result is disappointing.

DECOMPRESSION.

J. M. P., age 28, had suffered an automobile accident one month preceding first contact in October, 1941. This was followed by immediate left facial paralysis. No faradic response was present. At that time radi-

cal mastoidectomy was performed and facial nerve decompressed. Fracture line in squama extended through facial ridge into middle ear. Nerve was found to be frayed along inner wall of middle ear, but continuity was intact and nerve was not disturbed. This was a noninfected field. Five months after decompression, in March, 1942, patient revealed very definite return of function and a good result. When contacted by telephone recently, he stated he was getting along nicely.

2. L. A., age 7 had right simple mastoidectomy in January, 1942, followed by facial paralysis present on awakening. No reaction to faradic stimulation was noted when seen in April, 1942. At that time nerve was decompressed and found frayed in vicinity of semicircular canal, but continuity was intact and nerve was left undisturbed. This was a clean field. Functional improvement became evident one month following decompression. In January, 1943, definite return of function was noted, although frontalis muscle was still inactive. In May, 1944, examination reveals return of function in all branches, though not as yet complete in the frontalis muscle. There is also emotional function demonstrated at this time. Good result.

3. I. C., age 63, suffered an apparently spontaneous right facial paralysis in May, 1941, with no associated history. Faradic response was absent in March, 1942, and exploratory mastoidectomy was performed in April of that year. Decompression of facial nerve revealed it to be bluish and ecchymotic, and about four times its normal caliber. Linear incision was made along axis of nerve to sever fibrotic constrictions, but nerve was otherwise undisturbed. This was a noninfected field. Definite function was evident 11 months following decompression, in February, 1943. At the present time there is satisfactory return of function of middle and lower branches, but frontalis muscle is still inactive.

4. A. R., age 45, had chronic discharging right ear of many years' standing when first seen in May, 1943. In April of the previous year a radical mastoidectomy had been performed, following facial paralysis of two days' duration. Lack of faradic response was noted when seen in May, 1943. Facial nerve was decompressed in August of that year, at which time it was found to be embedded in granulation and scar tissue. Linear incision was made along course of nerve to sever any constricting fibrous bands. This was an infected field. First return of function was observed in January, 1944, eight months following decompression. Result, dry ear. At present, under physiotherapy, patient shows definite return of function of lower and middle branches, and a promising prognosis.

5. D. D., age 43, gave history of chronic suppurating left ear for 35 years when first seen in October, 1943, and a left-sided paralysis of one week's duration. No faradic response was elicited at this time. Radical mastoidectomy was performed in October, 1943, and facial nerve was decompressed. A large amount of cholesteatomatous tissue was found in the mastoid, and suppuration was present. The nerve was found to be bluish and edematous throughout its course and closely resembled the necrotic and granulation tissue in which it was embedded. First return of function was noted in January, 1944, and progressive improvement is apparent at the present time, with promise of satisfactory result.

6. G. D., age 41, underwent right radical mastoidectomy in June, 1943, for chronic suppurating right ear. Facial reaction was normal upon awakening, but paralysis was noted the following day. Four days after surgery there was loss of faradic response, and it was still negative one month later. Facial nerve was decompressed four months following onset of paralysis, in October, 1943. Return of facial function was first noted five months following decompression. Seven months after operation definite return was evident in lower and middle branches, and the ear

was dry. When seen in May, 1944, patient had well established functional return in the two lower branches, and was under the impression that some frontalis muscle function was developing. Gratifying result.

END-TO-END ANASTOMOSIS.

1. A. Y., age 12, had left radical mastoidectomy in September, 1937. On decompression in November of that year the nerve ends were approximated and sutured. This was an infected field. A long, stormy convalescence ensued, due to the patient's general physical condition, complicated by secondary aplastic anemia, and accompanied by recurrent hemorrhages from both nose and wound. Hemoglobin varied from 35 per cent to 14 per cent, which over a period of two or three years necessitated a total of 55 transfusions. In November, 1940, the first return of function was noted, with progressive improvement in function to the present day. When seen in May, 1944, the hemoglobin was 55 per cent, and definite function of lower and middle branches was evident, though frontalis muscle was still inactive. Satisfactory result.

2. J. F., age 25, experienced automobile accident in November, 1934, when facial nerve was severed. Right simple mastoidectomy was performed in February, 1935, and nerve found to be severed about 0.5 cm. distal to stylomastoid foramen. Cut ends were approximated with suture. This was a clean field. Three months following surgery, definite function was evident in the lower and middle branch, but the frontalis muscle remained inactive. Patient was last seen a year later, at which time he seemed to have a good result.

3. A. C., age 13, had facial nerve severed during right radical mastoidectomy for chronic discharging ear in March, 1942. Facial paralysis was noted immediately upon awakening with no response to faradic stimulation. Three days later, facial nerve was decompressed and found to be severed at the level of the semicircular canal. End-to-end anastomosis was performed with suture. This was a suppurating wound. First evidence of returning function was noted two months following surgery, and the cavity was healing nicely. Present examination reveals continuing improvement, though there has been no definite return of function of the upper branch. Good result.

4. S. W., age 3½, fell on glass gallon jar in July, 1942, severing left facial nerve. Operation at that time revealed the nerve to be severed 1 cm. distal to the stylomastoid foramen, and ends were approximated with suture four days following the injury. This was a clean field. Some return of function was noticed six weeks following surgery, and has been progressively increasing. At the present time there is definite return of function in all branches, including the frontalis muscle, with nearly normal eye closure. Very gratifying result.

NERVE GRAFT.

1. R. W., age 13, suffered injury to nerve during left radical mastoidectomy in June, 1939. In August following, a graft of external femoral cutaneous nerve was inserted and sutured in place. This was a suppurating wound. Restoration of function became evident about six months following the operation. Patient was seen at intervals up to May, 1944, at which time there was marked improvement in that this boy has readjusted to normal school life and plays clarinet in the school band. Good result.

2. R. McM., age 35, had left mastoidectomy in March, 1939, for chronic discharging ear, at which time facial nerve was injured. The following August about 1.5 cm. of external femoral cutaneous nerve was inserted and sutured in place. Suppuration was present. Due to lack of coopera-

tion, it has been difficult to secure progress notes, but when last seen in October, 1942, a very marked improvement was noted. Result satisfactory.

3. L. R., age 13, suffered severance of nerve during right radical mastoidectomy 10 months previous to first contact in December, 1940. At this time there was lack of faradic response. On operation in December, 1940, about 1 cm. of facial nerve tissue was found to be lacking in the vicinity of the semicircular canal. Nerve graft from the superficial peroneal nerve was inserted and sutured. Suppuration was present. Five months later, the first return of function was observed at the angle of the mouth, progressive return being evident at various intervals, and definitely established return of function by May, 1943. In August, 1941, some faradic response had begun, progressively increasing to May, 1944. Good final result.

4. J. K., age 54, gave history of discharging left ear for 30 years and paralysis seven years before first contact. In December, 1940, he had radical mastoidectomy, at which time the facial nerve was injured in removal of cholesteatoma and sequestra. There was lack of both faradic and galvanic response at this time. On decompression in January, 1941, the nerve was found to be severed, and about 1 cm. of external femoral cutaneous nerve was inserted and sutured in place. This was an infected field. Suggestion of return of function was noted about three months after nerve surgery. At the present time there is slight movement over the superior maxilla lateral to the nose, but the result is questionable and may prove to be unsatisfactory, mainly due to the long-standing of the paraparesis.

5. W. W., age 40, reported facial paralysis of three months' standing immediately following right radical mastoidectomy in July, 1937. Lack of faradic and questionable galvanic responses was noted postoperatively. Facial nerve was decompressed in July, 1941, and graft of external femoral cutaneous nerve, about 8 mm. long, was inserted and held in place by suture. Suppuration was present. Eight or nine months following the operation, patient apparently had returning function, but have been unable to contact her since. Result questionable.

6. M. K., age 36, had chronic suppurating right ear, and facial nerve injury following mastoidectomy six months previous to first contact in January, 1943. At that time both ends of severed nerve were identified and 1 cm. of external femoral cutaneous nerve graft was inserted and sutured in place. This was an infected field. Returning function was first noted 11 months following surgery, in December, 1943, with subsequent improvement. At the present time there is progressive improvement, although the frontalis muscle is still inactive. Good result.

SUMMARY NOTES AND COMMENTS.

1. Based upon my experience as evidenced in the above case histories, I am strongly impressed with the value and service rendered by facial nerve surgery. This impression is justified by achievement of both functional and emotional benefits, which are the goal of this surgical procedure.
2. The lack of faradic response may prove to be deceptive, as a spontaneous recovery may reward a regimen of patient observation and supportive treatment.

3. My impression is that there is a much greater degree of security in suturing, particularly in infected fields, than in merely laying nerve ends together. This feeling may be due mainly to the fact that most of the cases in my experience have been suppurative, requiring greater care to keep the graft in place; therefore, the occasion to use the latter technique has not arisen.

4. In facial paralysis with acute otitis involvement, surgery is justifiable only if indications for mastoidectomy are present. In Bell's palsy, indication for immediate surgery is questionable; I am not sufficiently satisfied with present-day diagnostic facilities, such as the faradic test, to feel justified in advising early exploration.* In facial paralysis with definite traumatic history, exploration is warranted, as it is in the presence of chronic suppuration.

5. The conception of the terms "satisfactory" and "unsatisfactory," as applied to results obtained, must, of course, be construed to be relative, as wholly normal return of function and appearance is never obtained; while, on the other hand, frequently an "unsatisfactory" result, though falling short of that which might be hoped for it, represents sufficient improvement over the original condition to justify the surgical procedure. It is my opinion that where return of function in the middle and lower branches is evident, the result may be considered good, as it is the usual experience of operators that restoration of the upper branch is rare in instances where the nerve has been severed.

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*In this connection it is of interest to observe that there is under construction at the present time a vacuum tube voltmeter, or "Microvoltmeter," as it is called by the designers, H. S. Burr, C. T. Lane and L. F. Nims, of Yale University, which may in the future prove of value in determining the continuity of nerve structure; however, in its present stage of development, it is my understanding that this instrument is too sensitive to be practicable, and will require perfecting before it can be approved for this purpose.

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UNILATERAL DEAFNESS.*

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The involvement of a single ear with a profound hearing loss immediately poses a problem for the otologist which may permit of early and immediate solution or may tax his diagnostic acumen to the utmost. From the very anatomic situation of the ears and their relation to the nasopharynx it might be expected that they would be equally vulnerable to adjacent upper respiratory infection; however, involvement of a single middle ear by acute infection is a matter of common occurrence and presents no serious difficulty in the matter of diagnosis and treatment. To all other unilateral involvements of the ears the cause of the loss must be determined and steps taken to safeguard the integrity of the ear that is still intact. The importance of this phase of the problem is a real one. No longer has the individual paired organs for the function of hearing. His margin of safety is greatly reduced. Though unilateral deafness is not a serious difficulty, it proves at times a very definite handicap, the disability being rated at approximately 10 per cent. In general this disability manifests itself by the greater susceptibility of the single ear to the masking effect of noise, the individual is confused in group conversations and in large gatherings. Speech and sounds on the side of the affected ear may be completely missed. The location of the source of distant sound is extremely difficult, such as an airplane in the sky.

Compensation can be largely achieved by reasonable alertness in anticipating the direction from which the sound or voice may come or by favorably establishing the position of the intact ear so that it is always directed towards the sound source. A loud tinnitus frequently occurs in the affected ear. This may at times be so intense as to introduce a certain masking effect upon the better ear. Unilateral deafness is not a disability which can be regarded with slight concern.

*Read at the Seventy-seventh Annual Meeting of the American Otological Society, Inc., New York, June 5, 1944.

†From the Otological Research Laboratory, Abington, Pa.

Editor's Note: This ms. received in Laryngoscope Office and accepted for publication, July 1, 1944.

The following study has been made from an analysis of 1,400 cases of hearing loss of all degrees of impairment from slight to complete. In this group 128 cases presented a unilateral hearing loss, or 9 per cent of the total. Fourteen per cent of the children with impaired hearing, 8 per cent of the adults, had a unilateral loss. The cases were classified according to their etiology into the following groups:

1. Infection with complications.
2. Toxic involvement of the neural mechanism of hearing resulting from acute streptococcus infection of the nasopharynx.
3. Trauma, direct and acoustic.
4. Ménière's disease.
5. Acoustic nerve and brain tumors.
6. Virus diseases. Mumps, both the parotitic and non-parotitic forms.

A careful history and complete audiometric studies are essential in arriving at a final diagnosis in all of the groups listed. It is hardly necessary to present details of the method of obtaining a history other than to urge its importance. Family history is of great significance, of course, and when really pertinent is an essential factor. Such data must be carefully weighed. Elsewhere attention has been drawn¹ to the easily available family history. Every individual with impaired hearing of any type soon becomes intrigued with the idea of searching his lineage for some forebear upon whom he can blame his present plight. Hereditary and embryonic deafness require a specific genetic formula, the actual demonstration of which is the exception and not the rule. Regardless of the otologists' concern about the prevention of deafness, it is doubtful if it will ever become an eugenic problem in our present generation.

The diagnosis of a unilateral deafness, however, is a precise and definite procedure. It must be established qualitatively and quantitatively beyond peradventure. It can be accomplished only by the most careful and thorough audiometric technical methods.

A routine audiogram is made and a disparity in the acuity of hearing between the two ears is demonstrated. For the general purpose of brevity and in conformity with the title of this paper it will be assumed that the better ear has relatively normal hearing. To be of significance this disparity between the two ears must be at least 30 decibels or more in the entire frequency range. When this fact is once established, the audiometric examination of the affected ear must be repeated with the better ear masked by appropriate means; i.e., a noise calibrated both as to frequency band and intensity level. Details of this procedure need not be enumerated here; they have already been described.² In no other way can a profound or complete unilateral deafness be established.

The type of hearing loss is the next problem to be determined. Experience has shown that in any loss of more than a 60 decibel average some perceptive factor is inevitable; however, this should be a matter of record. Bone conduction tests are suggestive but only properly executed loudness balance tests done whenever possible are conclusive. Naturally they cannot be carried out when the loss in the poorer ear is complete. By such means and with examination of the function of the labyrinth only is it possible to appraise the functional ability of the affected ear.

Specific consideration of the groups listed above follows:

1. In all unilateral infections resulting in a unilateral hearing loss or deafness, the history and audiograms are conclusive and direct. Therapy is specific. The problem is a relatively simple one and the prognosis is more or less indifferent (see Chart 1).
2. Toxic involvement resulting from acute streptococcus infection of the nasopharynx is not so simple. Either or both divisions of the VIIIth nerve may be affected; the acoustic branch most always, but not necessarily the static division. The prognosis here should be guarded since recovery seldom takes place (see Charts 2 and 3). The symptoms of labyrinthitis may have been present or absent, mild or severe, and, if the latter, will probably persist for some time and will subside only when the labyrinth becomes completely non-functioning.

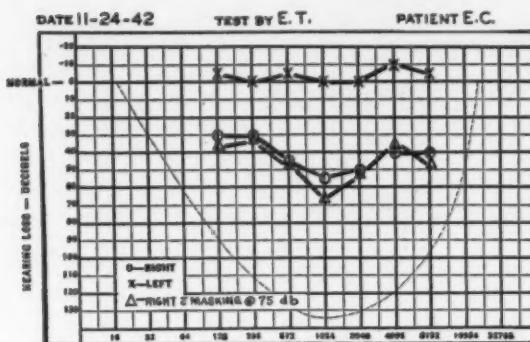


Chart 1. Patient E. C., male, aged 20. Chronic suppurative otitis media, right 10 years' duration.

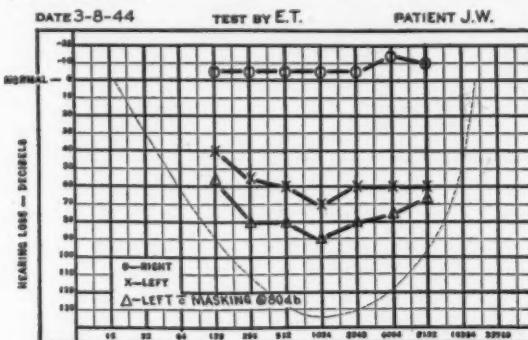


Chart 2. Patient J. W., male, aged 37. Acute streptococcal nasopharyngitis, followed by acute loss of hearing, left, and vertigo which had cleared up two months after attack. Response to caloric test, left, appeared in two minutes, 30 seconds.

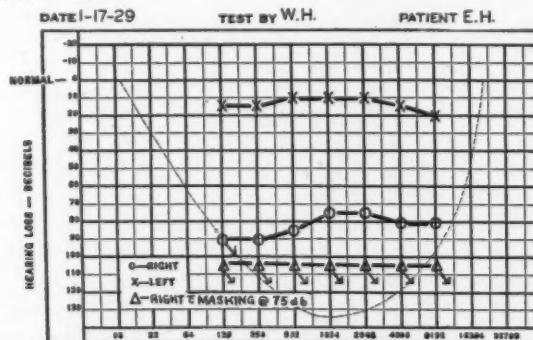


Chart 3. Patient E. H., female, aged 39. Acute streptococcal nasopharyngitis, three weeks before examination. Hearing loss in right ear noticed during attack, also extreme vertigo which was present at time of examination. No response in right ear on caloric test.

3. *Trauma:* Direct physical forces resulting in injury to the temporal bone with bleeding from the middle ear and escape of cerebrospinal fluid will result almost inevitably in complete destruction of the static and acoustic labyrinth in the affected ear. The damage done is final and complete and restoration of hearing seldom occurs (see Chart 4). Acoustic trauma and blast injury are matters of vital concern at the present moment. The former may result in a unilateral hearing loss (see Chart 5); the latter unhappily involves both ears in the majority of instances. This acute type of hearing loss is undoubtedly the most devastating of all from the psychologic standpoint.

4. *Ménière's Disease:* So much has been written on this subject in the past few years that any detailed consideration would be out of place in a general discussion of this kind; however, the disease itself and its so-called "pseudo" manifestations all require at times the diagnostic audiometric techniques involved in the final appraisal of any unilateral deafness. Moreover, the effectiveness of conservative therapy can be gauged or prognosticated equally well by careful audiometric study as by subsidence or relief of symptoms. Unfortunately, few reports of the effect of therapy have apparently been controlled by this type of examination (see Chart 6). Ménière's disease occurs in adult life — this particular aspect has never been explored or discussed thoroughly.

5. *Tumor:* Acoustic and cerebellopontine angle tumors can be diagnosed in their early stages only by means of the most careful and repeated audiometric studies. Neurosurgeons are apparently loath to operate on these cases until they present the classic picture. At this stage they may be operable but are seldom cured. Tumors involving the auditory nerve as an initial point of pressure are rather rare. Fowler, Jr.,³ reports four cases of acoustic neurilemma as occurring in his pathologic material over a five-year period. Every unexplained case of unilateral nerve deafness is potentially due to new growth. Such an etiologic factor must be ruled out. In this series of cases, four brain tumors have been observed, three of which were diagnosed. Four were operated upon and one survived. This particular case, a giant cell tumor of the submaxillary fossa, may be considered cured.

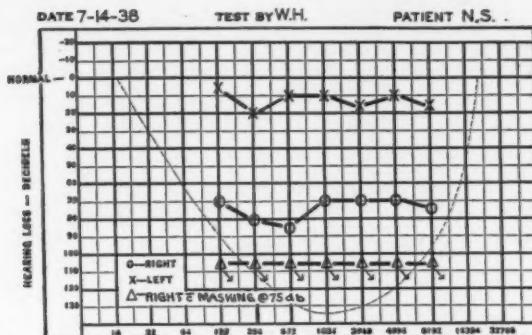


Chart 4. Patient N. S., male, aged 22. Struck over right ear with baseball. Had bleeding from ear at time of accident. No vertigo.

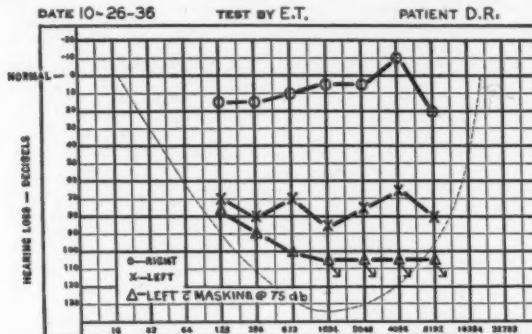


Chart 5. Patient D. R., female, aged 20. Firecracker explosion at age of 13. Hearing loss not noticed until a year later when difficulty in school work developed.

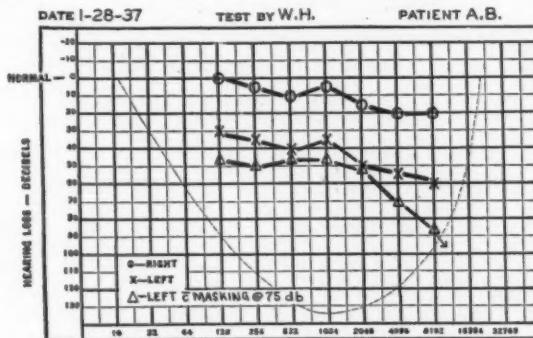


Chart 6. Patient A. B., male, aged 41. Has had hearing impairment in left ear with attacks of vertigo, nausea and vomiting for four years. Marked variation in symptomatology with remissions and exacerbations.

The number represents 0.028 per cent of the total series, 1.4 per cent of the unilateral deafness cases. Regardless of this slight morbidity per cent, the early recognition of an intracranial tumor involving the auditory nerve will remain one of the most challenging of all diagnostic efforts in unilateral deafness (see Charts 7 and 8).

6. Virus Diseases. Mumps: The problem of mumps deafness is a matter of peculiar and special interest and will be considered here in some detail. The fact that loss of hearing is a direct sequel of the disease parotitis has long been

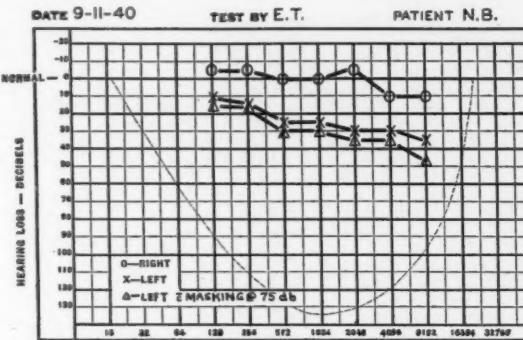


Chart 7. Patient N. B., male, aged 40. Beginning hearing loss in left ear. No intracranial symptoms at this time. However, IIInd, Vth, VIIth and VIIIth nerves eventually were involved. Patient died following operation.

known; also the fact that the hearing loss is most frequently unilateral is a matter of established record. There is no explanation for this remarkable manifestation of a systemic disease. In a report of possible etiologic factors of the deafened children at the Pennsylvania School for the Deaf in 1939,⁴ the deafness being bilateral in every case, of course, it was stated that mumps was not a related cause. At the present time, five years later, with a school population of 535 deaf children, five children give histories of a bilateral hearing loss developing after an attack of mumps. All of these children contracted the parotitis before the age of three. It is generally recognized that meningeal irritation, mumps encephalitis, is of frequent occurrence, ranging in severity of symptoms from mild to critical. Post mumps deafness is often complete, always irreversible. There may or may not be labyrinthine irritation. Permanent damage to

the static labyrinth seldom occurs but the acoustic labyrinth is destroyed. Lack of any specific data as to the pathology of this condition forces the assumption that the virus inflicts a fulminating damage upon the neural mechanism of the ear involved. Atrophy of the perceptive mechanism must be the end-result. Cases in which the disease mumps is an established fact and a unilateral deafness develops without labyrinthine involvement are not uncommon. The acoustic labyrinth in these cases is destroyed, the static labyrinth not necessarily so. In fact, absence of labyrinthine damage may well prove to be a differential diagnostic factor.

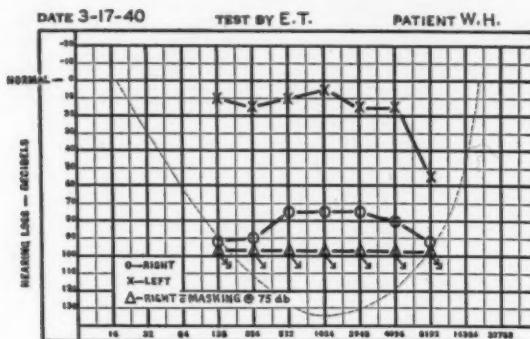


Chart 8. Patient W. H., male, aged 53. Onset deafness, tinnitus, finally involvement of IIInd, Vth, VIth and VIIth cranial nerves. Operation and radiation therapy. Growth stopped but hearing loss remained.

Recently Enders⁵ has demonstrated conclusively by skin tests and complement fixation studies that a significant number of young adults show an immune reaction to mumps without ever having had the clinical disease of epidemic parotitis. This may be called inapparent or subclinical mumps.

An unexplained unilateral deafness in childhood is of relatively infrequent occurrence. Its known relationship with frank parotitis is a matter of record. In Enders' series "50 per cent of the sera of those who denied having had the disease contained antibody." He further states, "It is possible, then, to assume with some confidence that nearly half of these individuals who gave reliable denials of having had mumps, at some time underwent an inapparent or silent infection. The experiment with the children yielded additional data of

the same sort. As one would expect in this group the percentage of negative reactors with negative histories was greater."

In this connection, data furnished me by Dr. Theodore Wilder on the incidence of contagious disease in the student body of the Germantown Friends School in Philadelphia is interesting. These data, based on a study of 600 children, indicate that at 16 years 83.2 per cent had had chickenpox, 88.3 per cent measles and 50 per cent mumps. Continuing this ratio to 20 years, 60 per cent will have had mumps as against 95 per cent measles and 90 per cent chickenpox. The 50 per cent of inapparent mumps demonstrated by Enders would easily make up for this apparent discrepancy in the incidence of these three diseases.

A possible relationship between subclinical mumps and unilateral nerve deafness seemed worthy of exploration. Through the auspices of the Commission on Measles and Mumps Board for the Investigation and Control of Epidemic Diseases, United States Army and the Department of Pediatrics of the University of Pennsylvania School of Medicine, material for making skin tests are made available and complement fixation tests were carried out by Dr. Enders, of the Department of Bacteriology, Harvard Medical School.

Out of the total series, 16 cases were available for the skin and complement fixation tests, 15 children and one adult. Of these cases, six had a positive history of mumps. There was no specific etiologic factor in the remaining 10. These cases came from all economic groups. In this group, ear, nose and throat examination was negative, the membrana tympani are entirely normal. All special examinations failed to contribute to the diagnosis. These included X-ray, vestibular, serologic and other examinations.

The age of onset of the hearing loss ranged from infancy to 16 years. In one case, a child of 6 years had an acute encephalitis with convulsions and fleeting paralysis of the lower extremities. This was followed by a complete loss of hearing in one ear. He had never had mumps. Another case, a physician aged 46, had been deaf in one ear since early childhood. On careful inquiry it was discovered that in infancy he had had an attack of "brain fever." He did not recall ever having contracted the disease parotitis. Both gave

an immune positive reaction to the mumps skin test material. The remaining members of this group gave no definite history of encephalitis other than some unexplained acute febrile disease in early childhood.

To quote Enders again, relative to his material, "These observations have led to the application of the test as an aid in the diagnosis of cases of encephalitis without definite parotitis, suspected, on clinical grounds, of being attributable to infection with the virus of mumps. In two of six such cases a significant rise in titer has been recorded; and in one of

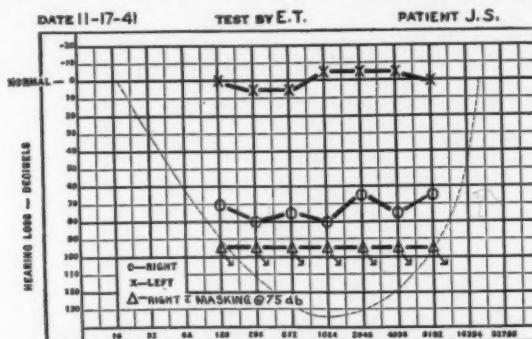


Chart 9. Patient J. S., male, aged 13. Mumps seven months before examination. During attack had severe tinnitus, vertigo and hearing loss. Treated elsewhere with Eustachian dilatation and bouginage for six months.

these two no antibody was demonstrated in the specimen taken three days after the onset. It is possible that our failure to demonstrate a rise in titer in every instance may be explained by assuming that the encephalitis is a relatively late complication of the infection.

"In the six encephalitis patients whom we have studied, however, and in whom the clinician suspected mumps virus as the etiologic agent, titers were obtained which were higher than all but one of the normal human sera we have evaluated. Thus we may suggest that in cases of suspected mumps encephalitis without parotitis the complement fixation test should be helpful in confirming the diagnosis."

Three children were examined who developed a unilateral hearing loss in the course of a frank attack of mumps. Only one of these, Case J. S., was available for the skin and complement fixation tests. His reaction was strongly positive (see Chart 9).

In contrast, Case R. P. gave a specific history of no mumps and that measles had been the only childhood communicable disease. His uncle is a physician. At the age of 5 years it was first noticed that he had a unilateral hearing loss. This condition has remained subjectively unchanged since then, until the age of 15, when his hearing was first adequately examined. His reaction to the skin and complement fixation tests was strongly positive. His hearing loss in the affected ear is almost complete and could be demonstrated only with appropriate masking (see Chart 10). The other cases with a

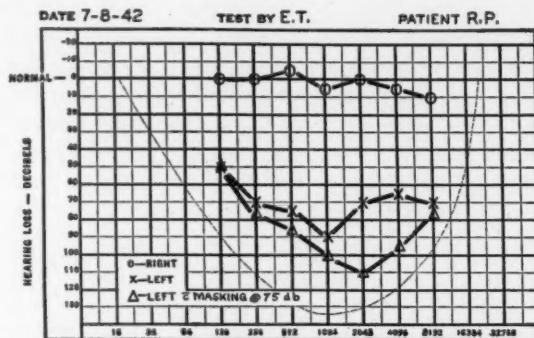


Chart 10. Patient R. P., male, aged 13. First noticed hearing loss at 5 years. Only contagious disease measles. Patient showed strongly positive reaction to mumps skin and complement fixation tests.

negative history of mumps, reacting positively, present the same type of hearing loss, varying only in degree. Of the six individuals examined with a frank history of mumps, reactions were all positive. The remaining number, 10, gave a negative history of mumps. Seven of this group gave a positive reaction indicating that at some time they had had a subclinical attack of mumps or the disease had not been recognized.

The question may appropriately be raised that any virus encephalitis, influenza for instance, might have the same effect upon the neural mechanism of hearing. This might well explain the three cases which gave negative reaction to these specific tests for mumps. Dr. Joseph Stokes, Jr., Professor of Pediatrics, University of Pennsylvania, School of Medicine, has outlined in a personal communication the following: "The fact that unilateral deafness has occurred coinciden-

tally with mumps would indicate that all cases of such deafness or unexplained bilateral deafness should have acute and convalescent sera collected for complement fixation tests with mumps antigen." He further states: "Positive tests for mumps are of no significance in relation to deafness, either unilateral or bilateral, unless they are done at the time and three to four weeks after the deafness has appeared. I realize that this is a difficult job, but it is important to make clear that there may be no connection between *the positive test and the deafness.*"

If further study and the accumulation of additional data warrant the possible relationship between inapparent mumps and unilateral deafness there are several interesting implications. Might not some of the completely sporadic cases of supposedly congenital or embryonic deafness, the children who do not acquire speech and after the age of 4 or 5 years are recognized to be deaf, have had in infancy an inapparent attack of mumps?

In Crowe's, et al.,⁶ important study of high tone loss deafness, no specific etiologic factor was established from all of their pathologic material. They demonstrated certain anatomic changes, specifically atrophy of the organ of Corti and nerve, stria vascularis and sulcus cells in their histologic material. They suggest that arteriosclerosis and nutritional factors may have been contributory. It would be quite reasonable to suppose from clinical findings that the virus diseases have, under certain specific conditions, a definite toxic effect upon the neural mechanism of hearing.

As a further argument in support of the necessity for careful diagnostic study, mention must be made of the rationale of therapy in these perceptive unilateral deafness cases and specifically those resulting from a frank parotitis. In this series, even the children developing deafness during an attack of mumps have been treated, some of them over long periods of time, by inflation and bouginage. Were an accurate diagnosis at hand the child would be spared all the discomfort of Eustachian tube therapy and the family would be spared the needless expense of futile procedures. But as a concession to anxious parents, no doubt, radium and X-ray therapy have and should be used. No harm will come of it. Vitamin B₁

invariably intrudes itself upon any scene where neural pathology is present. There is only one legitimate approach to the therapeutic problem; namely, safeguarding the unaffected ear from possible disease which might result in a bilateral hearing impairment. Any therapy instituted on any other basis must be considered unwarranted.

The above data is based on a small but statistically significant number of cases considering the incidence of unilateral deafness in the total number of cases of impaired hearing in the population. The following facts, however, are fully realized. Only two patients had had encephalitis and both gave positive reaction to immune tests for mumps. The final proof of the relationship of a unilateral deafness with an inapparent mumps must be the immediate detection of the hearing loss and a study of the mounting development of immune bodies by repeated serologic tests. Unfortunately, this particular specific demonstration of cause and effect will be difficult of attainment. Pediatricians generally are not as yet sensitive to the possibility of subclinical mumps. A hearing loss of this type is seldom recognized in children until they are well advanced in their primary school years. Parents seldom detect it. Cases referred to the otologist almost invariably come through the child's teacher or school nurse where adequate tests of hearing are being made in the particular school district. A unilateral deafness either in a child or adult can be demonstrated only by special audiometric techniques. The actual establishment of the relationship will depend on further specific clinical experience.

DISCUSSION.

Unilateral hearing losses, in most instances complete, have been reviewed under six categories. There may well be other causes of this condition but in the entire number of cases examined, no other etiologic factors were brought to light. Embryonic unilateral deafness has been reported. No such case has been observed in this series. The remarkable report in the *Australian Medical Journal* of Sept. 11, 1943, on the relationship between maternal German measles in the first three months of pregnancy and the appearance of embryonic defects in the infant, among them deafness, is extremely significant if the observation can be substantiated.

Unilateral deafness as such is not a matter of critical importance for the individual supporting the condition. It does, however, represent a specific type of disability, not serious perhaps, but nonetheless definite. With the exception of the audiograms represented in Charts 1, 6 and 7, the remaining audiograms are all readily interchangeable despite the fact that the cause of the hearing loss is in every instance entirely different.

Such complete deafness does not lend itself to any type of therapy. It does imply the necessity of accurate diagnosis of the hearing loss or deafness to obviate useless therapy. Having recognized the situation, the otologist must concern himself with the preservation of the hearing level in the intact ear. Pathology responsible for a unilateral deafness of itself is seldom responsible for a bilateral hearing loss. The necessity of diagnosing the specific cause of a unilateral deafness as in brain tumor is a matter which may mean "life or death" for the individual involved.

Adequate diagnostic procedures must be employed in these cases so that the actual cause of the hearing loss may be a matter of unquestioned record.

CONCLUSIONS.

1. Unilateral deafness is a significant factor in the total problem of hearing loss in the general population. In the present series of cases, 1,400 individuals with all degrees of hearing loss, unilateral deafness represents 9 per cent of the total. The percentage in childhood is 14 per cent, in adults 8 per cent. With modern methods of examination, unilateral deafness in children is and should be recognized early. Adults usually disregard the situation, which probably accounts for the difference in percentage incidence in the two age groups.
2. The great majority owe this defect to an acute or chronic infection. This situation permits of a correction of the cause but not necessarily the effect.
3. Most unilateral deafness cases are perceptive in character. They are diagnostic rather than therapeutic problems.

4. Direct physical trauma occasionally resolves itself without a hearing loss. Severe acoustic or blast trauma almost never.

5. Tumors of the neural mechanism of hearing are seldom recognized before permanent damage has been done. Surgery of acoustic or angle tumors is not one of the brilliant achievements of brain surgery. When symptoms have developed which demand surgery, cure is seldom if ever achieved. These patients very seldom survive a three-year period.

6. Ménière's disease is the most unsatisfactorily controlled of all unilateral hearing loss problems. Diagnosis is incomplete, therapy is haphazard, follow-up is inconclusive. No adequate explanation for clinical remissions and exacerbations has ever been presented. No single form of therapy is specifically outstanding.

7. It has been shown by Enders that mumps may have occurred in 50 per cent of individuals disclaiming any knowledge of the infection, this fact being demonstrated by positive skin sensitivity and complement fixation tests.

Unilateral deafness is a known sequel of the disease parotitis. Certain unexplained unilateral cases of deafness occur in individuals who give no history of having had mumps but show positive immune reactions to the disease.

The possible relationship between inapparent mumps and certain cases of unilateral deafness in children and adults is presented for consideration.

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SYMPOSIUM:
THE REHABILITATION OF THE WAR-DEAFENED.

I.—HISTORICAL AND VETERANS' ASPECTS.*

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The 1944 Annual Meeting of the American Otological Society, Inc., finds us in the midst of a titanic global war. We are told that over 1,000,000 men have already been discharged home. These show many casualties. As doctors we have a peculiar concern for the wounded. On May 11, 1944, the total military casualties were reported in the newspapers as 201,454. Of these, 44,778 (22 per cent) were from the Navy, and 156,676 (78 per cent) were from the Army; those listed as wounded were 12,070 (27 per cent) in the Navy, and 63,321 (41 per cent) in the Army, of which 37,009 (58 per cent) recovered sufficiently to return to active duty. This gives us a general picture of the many who are injured but does not give any detail as to the number of ear injuries we may expect. Dr. Hughson¹ has estimated in the recently compiled Manual that there were 40,000 aural casualties in World War I; and that since there are six times as many of our men engaged in this struggle, there should be close to a quarter of a million such casualties in World War II. These estimates seem too high. I early sought figures from Major Walter E. Barton,² of the Surgeon General's office, and was told: "If all of the cases of hearing disorders tabulated by the Surgeon General in World War I were added together, they would total only 6,000." Judging from the figures coming in during this war, he felt the number would be correspondingly small. Perhaps the speakers who will follow me will give us the last reports for the Navy and the Army. To me is assigned a brief review of our experiences in 1918 and then a consideration of what the Veterans Administration and the State Agencies are preparing to do for the war-deafened.

*Read as part of a Symposium at the Seventy-seventh Annual Meeting of the American Otological Society, Inc., New York, June 6, 1944.

Editor's Note: This ms. received in Laryngoscope Office and accepted for publication, July 1, 1944.

In 1917, Colonel Harris P. Mosher was Head of the Ear, Nose and Throat Department in the Surgeon General's office, and Lt. Colonel Charles W. Richardson concerned himself especially with the lipreading school for the soldiers which was being organized at U. S. General Hospital No. 11 at Cape May, N. J., under Major John M. Ingersoll; all three were members of this Society. To Cape May were sent the injured otological cases; and those that had any permanent severe impairment in their hearing were to be taught by the nine lipreading teachers and three speech training teachers especially selected for this purpose. During 1918 and 1919, 108 deafened soldiers³ received systematic training before they were discharged into civilian life. Inability to hear normal conversation beyond five feet was the criterion for rehabilitation training. The hearing aid was not so perfected in those days and did not enter into the program, as it so emphatically does now. The men worked hard at their task. The average time for completing the lipreading course was 2.7 months. How skillful were they? Some were slow in learning and gained indifferent skill; but 74 per cent were graded as understanding over 80 per cent of what their teachers said to them in their efficiency tests. This was a remarkable record. Then Miss Enfield Joiner, who succeeded Dr. Manning as head of the school, consented to go to Washington for yet another year as the Federal Board Agent concerned with finding and taking care of those who did not find their way to Cape May. Through Leagues for the Hard-of-Hearing, Red Cross workers and other agencies, she discovered 500 more of these handicapped men and secured for them the civilian lipreading teachers they needed. How well did they do after discharge? She was able to keep track of the men going out of the Cape May school and reported that all did as well financially and some better than they had before they became deafened. This was a chapter in reconstruction in which the individual members of the American Otological Society, Inc., played a prominent part, and of which we are rightly proud; furthermore, it has served as a pattern for the more extensive and finer work being done in this war.

Early in the present cataclysm, our members volunteered for any service desired of them. The Army wanted manuals to guide the men in the field. Among others that were com-

piled, a worthwhile volume on otolaryngology was assembled by Dr. Mosher and his committee, of whom a goodly number were our Fellows. Then, in 1942,⁴ this Society and the American Laryngological Association appointed Dr. Mosher, Dr. Coates and Dr. Berry to further any rehabilitation program that the military authorities might contemplate. Much correspondence was necessary with the Surgeons General of the Army and Navy and the Veterans Administration to discuss the successful program of 1918, and the need for a more formidable program now.

These discussions may be summarized: At first⁵ the Army and Navy planned to restore such men as they could to active duty, and to discharge all others through the Veterans Administration, where all rehabilitative measures would be handled. We suggested that there was a period between the incurring of the aural casualty and the final discharge when various surgical and psychiatric services might be necessary, a period which could be used advantageously. On Feb. 19, 1944, in accordance with War Department Circular No. 81, Section 4, it became the policy of the Surgeon General of the Army⁶ "to retain for fitting with hearing aids and for lipreading instruction, all soldiers who have impaired hearing. Those that can be salvaged will be returned to duty. Those whose loss is such that they are felt to be unfit for further service will be discharged."

Captain Schenck, who has served so brilliantly in the Navy and who heads the otological faculty on War-Time Graduate Medical Meetings, will tell us how the effort in the Navy is progressing. Lt. Colonel Mobley, who began this Rehabilitation Program for the War-Deafened at the Walter Reed Hospital and was then transferred to the Deshon General Hospital, was planning to discuss the work being done in the Army. Illness prevents his participation. We hope his recovery will be speedy and complete. Happily, Captain Truex, who has shared in Colonel Mobley's labors almost from the first and is now Acting Chief of Rehabilitation at the Deshon Hospital, has consented to speak in his place. Dr. Lierle will tell how the civilian doctor can help. My part is to outline what happens to the occasional aural casualty that does not find its way into the rehabilitation centers provided, but is discharged directly into civilian life. There are

two types of such casualties, one that becomes deafened "in line of duty" and the handicap is "service-connected"; the other was "not in the line of duty" and the handicap is not "service-connected." In general the service-connected case may look to the Veterans Administration for help; the non-connected case may look to the Federal Security Agency and the State Vocational Rehabilitation Services. Let us consider these in more detail so that we will be informed, in case a war-deafened soldier seeks our individual advice and help.

First, consider the service-connected case.⁷ Before discharge "the veteran makes application for pension (V A Form 526), which initiates a determination of pensionable disability producing a vocational handicap. If such handicap is present, he will be advised to make application for vocational training." He may arrange with the local Red Cross⁸ for further lipreading instruction near his home.—After discharge, the veteran's application and records are forwarded to that one of the 52 established Veterans' field stations having jurisdiction over the territory in which he resides. In the field with which we are especially concerned—"the sensory handicapped"—the Veterans Administration⁹ plans for a central staff of experts in Washington to "give over-all supervision of the vocational rehabilitation of veterans, and spend most of its time in the field working on the problems of specific cases where its services may be needed."

If the Veterans Administration finds "the disability service-connected, if the veteran was in active service after Dec. 6, 1941, and was honorably discharged, and if he is in need of vocational rehabilitation to overcome the handicap of such disability," he is entitled¹⁰ (Public Law No. 16, 78th Congress) to the training needed to restore his employability. With the Veterans Administration's approval, "any educational institution or well established enterprise may be utilized for institutional on-the-job training." This course of instruction can be up to four years in length, and will be available for six years after the termination of the present war. For this training the Veterans Administration uses civilian institutions with which it makes contracts. This applies to all kinds of disability cases. In aural casualties, it supplies repairs and batteries for the hearing aids given the veteran before his discharge, and it provides the usual dis-

ability compensation or its equivalent in earned wages. There is no further hospitalization contemplated after discharge and no formalized lipreading instruction under military auspices. So much for the veteran whose disability is service-connected.

The man whose deafness is not service-connected (not in line of duty)¹¹ has recourse to Public Law 113 of March, 1943, in order to secure vocational training. Here the Federal Security Agency becomes operative, in contradistinction to the Veterans Administration which handles only service-connected cases. The Federal Security Agency, operating in conjunction with established State Vocational Rehabilitation Services, "will provide vocational training to overcome handicaps whenever an individual (whether military or civilian) requires it, and will provide preferential handling to veterans with nonservice connected disabilities." The Vocational Rehabilitation Amendments,¹² approved by the President on July 6, 1943, provides for a peacetime as well as a wartime program. It includes any services necessary to render disabled persons capable of engaging in remunerative employment or to render them more advantageously employable. These include surgical and medical care, hospitalization, therapeutic treatment, artificial appliances, vocational guidance and training, maintenance during training, and placement in employment. Mentally as well as physically disabled individuals are eligible. Specific provision is made for war disabled civilians, including citizens' defense corps, aircraft warning services, civil patrol and the Merchant Marine. For these specific groups the Federal Government will assume the entire cost; and half the cost in others, the local state paying the remainder, with certain exceptions where the disabled civilian is able to pay for medical care. Where needed, the cost of maintenance while the vocational training is progressing, is also paid by the government.

The Federal Security Agency¹³ had not, at the time of this writing, "issued any material to the state rehabilitation agencies specifically relating to aural disabilities." They plan¹⁴ to distribute to the states copies of the Manual for Rehabilitation of Aural Casualties sponsored by the Hearing Conservation Committee of the American Academy of Ophthalmology and Otolaryngology.

On May 18, 1944, the House of Representatives passed the so-called "G. I. Bill of Rights" for war veterans. It is expected the Senate will also pass it. This gives among others the following benefits: 26 weeks of unemployment compensation at \$20 a week; loans up to \$2,500; tuition up to \$500 a year for four years, in school or college; employment service and job placement.

We have thus described the proposed activities of Congress, of the Veterans Administration, of the Federal Security Agency and of the State Vocational Bureaus. There remains one more: the local agencies of many and varying kinds. All will want to help. Happily, under the leadership of the local Legionnaires or Veterans of World War I, some have combined with local municipal help to set up a central agency, a clearing house for all these activities. In Worcester, we have commodious rooms, a full-time staff, volunteer consultants in the various expert fields (educational, industrial, medical, legal, religious), and the necessary equipment including photostating and filing. Here the distant soldier or his wife at home, or the returned soldier, can learn promptly and authoritatively what he needs to know, and secure kindly guidance and help along the way.

May we not conclude that our nation is earnestly seeking to follow the behest of our great Abraham Lincoln in his immortal second inaugural address: "Let us strive to finish the work we are in: to bind up the nation's wounds; to care for him who shall have borne the battle, and for his widow, and his orphan — to do all which may achieve a just and lasting peace among ourselves and with all nations."

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36 Pleasant Street.

THE AMERICAN LARYNGOLOGICAL, RHINOLOGICAL AND OTOLOGICAL SOCIETY, INC.

The Forty-Ninth Annual Meeting of the Society was held at the Waldorf-Astoria in New York City, June 9 and 10, 1944, Dr. H. Marshall Taylor presiding. There were in attendance 203 members and 59 guests.

From present indications the 1945 Annual Meeting will be held at the Drake Hotel in Chicago. The Section Meetings in 1945 will be held in the following places—dates to be announced later:

| | |
|-----------------------|--------------------|
| Eastern Section..... | Philadelphia, Pa. |
| Southern Section..... | Charlotte, N. C. |
| Middle Section | Indianapolis, Ind. |
| Western Section..... | Los Angeles, Cal. |

Mail from the following men is being returned because of incorrect address or for other reasons: Dr. William C. Braislin, Brooklyn, N. Y., and Dr. F. E. Hasty, Brentwood, Tenn. Can you give us information concerning either of them?

SYMPOSIUM:
THE REHABILITATION OF THE WAR-DEAFENED.

II.—THE REHABILITATION PROGRAM OF
THE NAVY: AURAL CASUALTIES.*

COMDR. FRANCIS L. LEDERER, U.S.N.
(by invitation).

Our outstanding military strategists of this war have been students of the tactics employed in all of the wars of the past. While rehabilitation has a historical background of the centuries, this effort is a novel one in that we are aroused to its importance even in the heat of the battle. We wish to salvage out of the casualties as many human lives as we can and always to bear in mind the Navy Medical Corps motto: "To keep as many men at their guns at all times as is possible."

Either the last war was decided too early for any concrete program to be instituted, or we were lacking in vision. Statistical material gained from experiences of World War I are woefully weak in providing a basis for our present program. Furthermore, for 25 years since that time we were doing little more than attacking the problem with a symptomatic, if not a palliative attempt to take care of the hard-of-hearing by acts of benevolent compensation rather than by those of helpful educational and vocational guidance. No facility existed for this special field until 1943-1944.

It would be conjectural, and even hazardous, to estimate the aural casualties of this war. We have no authoritative source of statistics from the last war to guide us. To separate the pathological ears which existed prior to enlistment from those actually associated with diseases or trauma sustained as a service-connected disability is like separating the chaff from the grain. We are fortunate in the Navy in that selection of our personnel was conducted carefully. That the

*Read as part of a Symposium at the Seventy-seventh Annual Meeting of the American Otological Society, Inc., New York, June 6, 1944.

Editor's Note: This ms. received in Laryngoscope Office and accepted for publication, July 1, 1944.

method is eminently practical is substantiated by the fact that in this group we find comparatively few cases whose hearing disability existed prior to enlistment. We can, therefore, readily justify our desire for an all-out effort in the rehabilitation program, knowing that we have the full responsibility of the serviceman's deficiency.

The rule, rather than the exception, is to find that our men would prefer to remain in the service. Whenever a man's past education, experience and record warrant, every attempt is made to rehabilitate him to the point where he can be returned to limited duty to perform those tasks for which he is best qualified. If this is not possible, it is our purpose to give him a basic course in lipreading, provide him the machinery for taking his place as a useful member of the community, and, wherever indicated, to furnish him a properly fitted hearing aid. In regard to the latter, it must be stated that hearing aids are to be provided, not on the basis of the rehabilitee's desire for one but only in such instances where he may be benefited by it. Indiscriminate distribution of such apparatus constitutes a waste of material and time. Furthermore, the serviceman must be given opportunities of social contacts while wearing an aid so as properly to bring about his adjustment to its use. It is our opinion that whereas he may feel quite happy about wearing an aid as a member of an institutional group, he may not react so favorably when he returns to a civilian status.

It is self-evident that the American Otological Society, Inc., finds itself interested in the rehabilitation program of the armed services. In offering a brief outline of the rehabilitation effort of the Navy, we are ever mindful of the fact that your Society as well as other similar scientific bodies are not only vitally interested but have effectively influenced these plans by your past efforts and by the willingness of individual members who have given so unselfishly of their time. We believe that if our effort is to be fully realized, both in a scientific and practical manner, it must be a fundamental principle that we maintain a liaison with groups such as your organization represents. It will be possible for us in the future to present to you carefully controlled studies of cases, so that, when the need arises, we shall not be traversing such uncharted seas as now confront us. Statistical data

will furnish a basis for many types of research problems of the future and the solution to many of our perplexing otologic entities.

In establishing an office of Rehabilitation of the Bureau of Medicine and Surgery, the Surgeon General, Admiral Ross T. McIntire, stated that, "Rehabilitation shall be interpreted as meaning all activities and services which may be required to supplement the ordinary or usual therapeutic procedures in order to achieve maximum adjustment of the individual patient either for further military service or for return to civil life with the least possible handicap from his disability." To this end, the Office of Rehabilitation has coordinated the efforts of separate hospitals with a unified Medical Department Program. It has assumed responsibility for assembling and disseminating information as to methods and procedures of demonstrated values, and for procuring, by consultation with recognized authorities, advice in specific problems. At its disposal are all services and activities required to supplement ordinary therapeutic procedures.

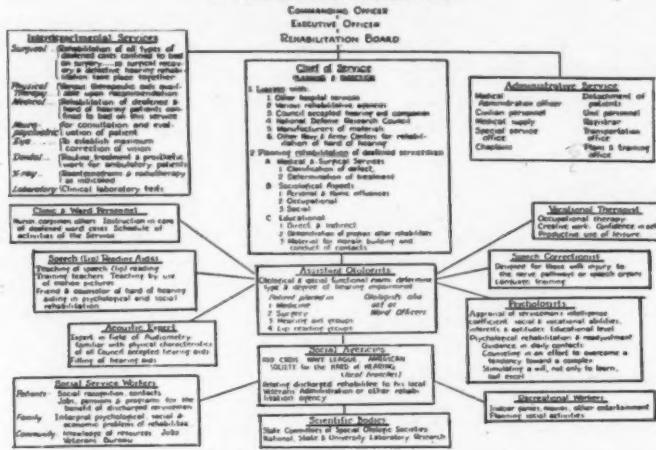
The Rehabilitation Program in each Naval Hospital is in charge of a Rehabilitation Officer selected by the Medical Officer in Command, on the basis of interest in the subject, aptitude for organizing, and talent in obtaining cooperation. Other members of the Medical Staff are designated to act with the Rehabilitation Officer as a Rehabilitation Board. The Chief of Medicine, the Chief of Surgery, the Chief of the Eye, Ear, Nose and Throat Department and a psychiatrist are usually members of the Board, but the size and composition of each Board is determined by the patient population of the hospital. Every Naval Hospital has a Rehabilitation Board.

Adequate personnel and equipment is to be made available at certain Naval Hospitals for the investigative phase of the rehabilitation program. Most Naval Hospitals will be able to carry out the full requirements of actual rehabilitation. In others, where the facilities for rehabilitative efforts are inadequate, personnel and equipment will be amplified. The Office of Rehabilitation has provided selected hospitals on both the east and west coasts and central depots for the management of aural casualties in need of special rehabilita-

tive efforts. These hospitals have been especially designated for this purpose in metropolitan areas, in close proximity to medical schools, universities, institutions for the hard-of-hearing, and where there are facilities for the training of lipreading instructors, speech correctionists, as well as other types of specialized personnel.

The specific purpose of the Navy in its Hearing Rehabilitation Program is to provide facilities for the examination and guidance of its personnel who have been hospitalized because of a disabling hearing loss.

**REHABILITATION FOR THE HARD OF HEARING
U. S. NAVAL HOSPITAL, PHILADELPHIA, PA.**



The accumulation of significant data, as well as the intelligent direction of therapy depends primarily upon thorough examination and investigation (see Fig. 1). This embodies the following:

1. Determination of the type and degree of the hearing impairment with regard to the amount of serviceable hearing remaining, as a result of carefully conducted functional tests and audiometry.
2. Complete physical examinations with special reference to the upper respiratory tract.
3. Ophthalmological examination to establish maximum correction of vision.

4. Utilization of other departmental facilities as indicated.
5. Psychological appraisal to establish: *a. Mental ability.*
- b. Educational level. c. Personality adjustments. d. Abilities or disabilities. e. Vocational interests and aptitudes.*
6. Speech (lip) reading instruction.
7. Speech correction.
8. Vocational and educational guidance.
9. Fitting of a suitable hearing aid when indicated.
10. Medical and surgical therapeutic indications for the improvement of hearing.

The diagnosis and prognosis of the hearing loss depend upon the history, otoscopic study and complete functional hearing examination. Examining personnel carrying out audiometric tests must be highly trained and in sufficient number for all Naval Hospitals. We are cognizant of the fact that determination of the hearing loss by the audiometer does not in itself constitute a diagnosis. It is, therefore, imperative that individuals performing these tests are properly trained in acoustics that they may better understand the problems involved. The Office of Rehabilitation has specifically directed that all audiometric examinations and special tests be conducted in a soundproof room, and that a Council accepted discrete frequency audiometer be used for measurements of both air and bone conduction.

Any serviceman with a line of duty hearing disability of 30 dcb. or more in the better ear (for the conversational range 256-2,048), is qualified for special rehabilitative efforts. It is expected that a small percentage of aural casualties will be rehabilitated by medical and surgical efforts alone. The great majority will require, in addition, the fitting of hearing aids, instruction in lipreading and speech training.

Such an intensive program of diagnosis, treatment, re-education and follow-up cannot be a part of a hospital's busy Eye, Ear, Nose and Throat Clinic. The Office of Rehabilitation has, therefore, organized separate units in two naval hospitals. These are adequate in size and facilities to handle the maximum estimated number of aural casualties without hurry

or confusion. In addition to other special equipment, each unit includes examining rooms, and individual rooms for lip-reading instruction and speech correction.

It is recognized that the most important single factor in the medical and social economic rehabilitation of servicemen with acquired hearing loss is the use of hearing aids. For the physiotherapeutic adjustment of the patient, preliminary tests are made with a representative group of Council accepted hearing aids. Individuals trained in the fitting of hearing aids, and familiar with all of their physical characteristics are part of the unit's staff, and no commercial factor is permitted to figure in this effort. After adequate examination, entailing trial on several occasions, the appropriate aid is selected by the Board and advice as to the usefulness of the aid is given, based upon the result of scientific study. Personnel and facilities are available for making individual ear molds.

The value of lipreading to those with partial hearing losses and as an adjunct to the hearing aid is appreciated. It is, of course, regarded as obligatory for any serviceman with a line of duty hearing loss of 30 decb. in the speech frequency range, and is given to all personnel not amenable to artificial aid and to those who have hearing defects regarded as progressive.

With few exceptions, it is necessary to derive speech reading instructors and speech correctionists from University Speech Departments, from the professional lipreading instructors still available, and from State Rehabilitation Departments. At some Naval Stations, special classes in schools for the deaf and Leagues for the Hard-of-Hearing have been organized. At the present time members of our Wave Corps, who have had some training in phonetics in their college education, are being trained in these special fields. Instruction in lipreading is being taught the serviceman as a basic course, arrangements being made for the rehabilitee to continue his work in a city nearest to his home or place of employment.

In severely deafened individuals, speech training is essential, and insofar as practical, when the proper personnel is not available, the speech clinics in State Universities, Colleges and Teachers' Colleges are utilized for this purpose.

Probably the most important single item is the psychological appraisal of the individual rehabilitee's intelligence coefficient, interests and aptitudes, educational level and social and vocational abilities. The vocational adjustment is carried out by specially qualified personnel with the cooperation of experienced counselors in vocational guidance available in State Departments of Rehabilitation, or at State Universities and Colleges. The groundwork for the patient's readjustment to civil life depends upon vocational analysis. The latter requires the sympathetic assistance of a psychologist and psychiatrist with experience in the management of the deafened. The object of these combined efforts is to place the individual in occupational levels which are self-sustaining and even creative. Vocational training is not necessary in every case, for deafness may not be a handicap in the pre-service occupation of the patient. When the handicap necessitates entry into an entirely new field it becomes necessary to evaluate the man's total training and experience in the light of his ambitions for postservice activity and the limitations imposed by his disability.

Rehabilitative efforts during hospitalization are directed toward achieving the maximum preparation for the proposed course of action after discharge. These efforts are directed along lines of practical prevocational training in the shops and other activities of the hospital or through facilities available from the Educational Officer. Careful vocational guidance is especially important during the period of hospitalization to bring about a productive use of leisure and to restore self-confidence.

Prior to discharge, the patient is referred to the representatives of the Veterans Bureau Administration for the purpose of arranging any benefits afforded by that agency to which he may be entitled. He is advised of opportunities for re-employment which may be available from such agencies as the Veterans' Re-employment Service and is offered the assistance of the Red Cross in arranging his private affairs.

The aim of these rehabilitative efforts is to prepare the man for resumption of an economically independent status in civil life and in a line of endeavor which appears to offer

opportunity for a permanent career. It has, therefore, been found advisable to exercise great caution in accepting offers of private individuals or organizations to participate in counseling and guidance of casualties in their postservice adjustment.

Upon the recommendation of a reviewing board for the discharge of a Marine, this information is transmitted to the Marine Corps Personnel Section in Washington, D. C., who in turn advise the various District Rehabilitation Officers of the Marine Corps. Prior to actual discharge from the service, the patient is interviewed by the District Rehabilitation Officer to ascertain if the Marine has been informed of the privileges and benefits of veterans' pensions and compensations, knows the sources of referral for employment and is advised of the continuing friendly interest of the Marine Corps in him even after discharge from the service. Contact will be maintained after discharge by correspondence from the Rehabilitation Section of the Marine Corps at Washington, D. C., and by voluntary contacts on the part of the discharged serviceman with the District Rehabilitation Officer nearest his home.

Considerable attention has been given to an efficient follow-up service of Navy and Marine Corps personnel. Such service may in some instances be necessary over a period of years in order to ensure adequate adjustment to and service from hearing aids, satisfactory adjustment to the social and occupational environment, and to prevent exploitation.

It is unfortunate that many plans for the postwar period remain nebulous. Only now is sufficient data accumulating to serve as a basis for practical programs. The numbers of blast casualties are mounting beyond those of other conflicts because of the greater numbers of men in our armed forces, the unprecedented expansion of naval warfare and the effects of detonation of more powerful explosives. There are many new problems in the rehabilitation of aural casualties. Military medicine will welcome the cooperation of this Society and other scientific bodies in their solution.

SYMPOSIUM:
THE REHABILITATION OF THE WAR-DEAFENED.

III.—HEARING REHABILITATION AT
DESHON GENERAL HOSPITAL.*

CAPT. E. H. TRUEX, JR., M.C., U.S.A.

Our service for the rehabilitation of the hard-of-hearing had its origin at Walter Reed General Hospital about one year ago under the direction of the Ear, Nose and Throat Section. Within a few months it became apparent that the magnitude of the problem to be solved and the volume of the patient-traffic to be handled was far greater than originally anticipated and required facilities and personnel that could not be offered at Walter Reed. The project was, therefore, transferred to Deshon General Hospital in Butler, Pa., on Nov. 1, 1943, and established in that institution as a service distinct and separate from the medical and surgical services. Similar programs were inaugurated at Borden General Hospital in Chickasha, Okla., and Hoff General Hospital in Santa Barbara, Cal., but as yet neither of these has approached the size of the center at Deshon. Since Nov. 1, 1943, more than 600 patients have been admitted to our hospital because of defective hearing, and we are now carrying more than 300 on the roster.

It is difficult to estimate the number of aural casualties that will be sent to these three centers as a result of this war. Certainly the number will vary directly with the intensity and duration of the holocaust. On Aug. 28, 1943, the Veterans Administration was paying compensation to 12,813 men for partial or total disability because of hearing defect incurred as a result of military service during the last war.¹ In spite of the fact that these auditory deficiencies are labeled "service-connected," I am certain that a reasonably high percentage of them were incurred "not in line of duty." I base this statement on the fact that an astonishing number of men in our clinic whose induction examination showed no

*Read by invitation at the Seventy-seventh Annual Meeting of the American Otological Society, Inc., New York, June 6, 1944.

Editor's Note: This ms. received in Laryngoscope Office and accepted for publication, July 1, 1944.

evidence of aural abnormality gave a history of or showed clinical evidence of long-standing auditory deficiency. We routinely obtain photostatic copies of the original examination of each man who is admitted to the service. A recent analysis of 100 cases, in which a definite history of subjective hearing impairment before coming into the Army was elicited, revealed that 53 per cent of the induction examinations gave no indication of a hearing loss. Undoubtedly, many thousands of men will be deprived of a small degree of their hearing in one or both ears, but will not be sufficiently handicapped to necessitate hospitalization for rehabilitative measures. They will, however, be entitled to remuneration. The personnel of the armed forces is approximately five times as great as in 1918, and all signs indicate that our part in the present conflagration will last two or three times as long as it did in World War I. It is my opinion that the Veterans Administration 25 years from now will be paying compensation to more than 100,000 men and women because of defective hearing attributed to this war. Furthermore, I am of the opinion that about 10,000 patients will be admitted to these centers during the next two or three years. A few hundred men were no doubt discharged from service because of impaired hearing prior to the initiation of rehabilitative benefits, but the Veterans Administration has recently declared its intention to ferret out each of these men and offer him the opportunity to take advantage of existing facilities. War Department Circular 81 was issued on Feb. 23, 1944, and was disseminated to Army medical installations both here and abroad. Section IV, paragraph 2, states that:

"Every case in which the impairment of hearing shows a true loss in the better ear of 30 decibels of hearing within the conversational range (265-2,048 decibels) or a loss to 3/15 or below to whispered voice, when an audiometer is not available, in a case of stationary or progressive deafness free from acute inflammatory aural disease, will be transferred in accordance with existing regulations to a hospital designated for the rehabilitation of the deaf at the earliest practicable date."

This directive constitutes an order, and since its dissemination the rate of admissions to our hospital has risen 75 per cent over the preceding three months.

Much publicity has been given to the statement that every combat aviator will suffer a permanent hearing impairment. It has also been emphasized that the concussive violence of modern explosives, the constant din of high powered motors in planes and tanks, and the prolonged exposure to the crack of rapid fire weapons will result in an enormous number of partial deafness cases. Most of these cases will not reach our clinics, but will be classified as "potentials," and undoubtedly will swell the number of hearing rehabilitees over a period of 10 or 20 years.

Most of our patients were inducted into the Army with hearing impairment. As a matter of fact, in a series of 392 consecutive cases admitted to Deshon, 271, or 69 per cent, fell into this category.

In this series of 392 cases only 58, or 14.8 per cent, attributed their disability to blast or noise. Nineteen of the pre-induction cases claimed marked aggravation of their hypacusis as a result of these factors, making a total of about 20 per cent of the whole with acoustic trauma as an etiological agent. Only one case was incurred as a result of aviation — a tail gunner in a bomber over the Ploesti oil fields sustained a severe catarrhal otitis media in one ear and a rupture of the opposite eardrum as a result of a rapid 8,000-foot drop.

Any description of the work that is being done at Deshon General Hospital involves the following fields of thought:
1. purpose, 2. objectives, 3. personnel and equipment,
4. methods.

1. Purpose:

The purpose of such an organization is to restore the individual hard-of-hearing soldier to the Army or to civilian life with an optimum of speech perception and a minimum of that maladjustment that so frequently results from this type of sensory handicap. Rehabilitate means "to restore to a former condition or status," and as applied to the deafened patient it involves a careful integration of various phases of the medical, physical and social sciences into a pattern of

therapy which is adaptable to a group or to an individual alike.

2. Objectives:

In order to fulfill the purpose for its existence, the Rehabilitation Service has certain objectives as follows:

1. To make an accurate diagnosis of the existing maladies by taking a complete anamnesis and by doing careful clinical and laboratory examinations.
2. To institute local and general therapeutic measures designed to improve or cure abnormalities that are discovered.
3. To give intensive instruction in the art of lip-reading.
4. To supply each individual with the best available hearing aid for his particular loss provided sufficient measurable benefit warrants the use of such an instrument.
5. To teach each patient to whom an aid is given how to use that aid to his maximum advantage in conjunction with his residual hearing and his proficiency in reading lips.
6. To prevent and correct deteriorations in speech which may quickly jeopardize satisfactory social and economic adjustment.
7. To assist the victim in avoiding the pitfalls of seclusion and introversion, of mental and emotional aberrations that so frequently stalk in the wake of his handicap.
8. To assist those who are unfit for further military service in continuing rehabilitative measures, if necessary, and in assuming their places in society as normal, useful citizens.

3. Personnel and Equipment:

At Deshon General Hospital the ever-increasing volume of patient-traffic has necessitated a proportionate increase in personnel. Excluding nurses and ward corpsmen, there are 10 Army and 21 civilian employees devoting their entire time to the program. This group of 31 is made up of four otologists, one psychologist, one acoustic physicist and four acoustic technicians, two speech correctionists, one instructor in the use of hearing aids, and 19 lip-reading teachers.

The hospital unit is a permanent structure and at the termination of this war will almost certainly be taken over by the Veterans Administration. The first of two new buildings exclusively for the rehabilitation service is now being occupied. The second building is under construction and will be completed in about one month. Besides administrative office space and medical examining rooms, 30 small rooms will be used for individual lip-reading lessons and one large room equipped with a group-hearing aid will be devoted to practice classes. The acoustic section of the building is divided into a large workshop, three soundproof chambers including one talking room and two sound-treated rooms for audiometric studies. The finest available equipment is being acquired for diagnostic examinations and for the comparative evaluation of hearing instruments that are being tested for each patient. Another large section was designed for instruction with moving pictures and for the special needs of auricular training.

4. Methods:

All conventional methods of medical therapy are being employed to effect a permanent improvement in the auditory acuity of our patients. Results are far from encouraging. A few cases are considered amenable to the fenestration operation, but this surgical procedure is not being done in Army hospitals. More than 90 per cent of our patients have a mixed or perceptive type of hearing loss according to the usual methods of testing indicating damage to the neural mechanism. Since cure is out of the question and significant beneficial therapy is only a forlorn hope, hearing aids combined with visual speech reception are the mainstays of hearing rehabilitation.

The government has authorized us to purchase any hearing aid that is accepted by the Council on Physical Therapy of the American Medical Association for any soldier regardless of the cause or duration of his disability when examination shows that such an aid will materially improve the hearing of the individual concerned. The Commanding Officer at Deshon General Hospital has permitted such broad interpretation of this directive that we have purchased bone conduction hearing aids for two men who had no discernible

residual hearing. It was found in each of these cases that the receiver strapped to the wrist or held in the fingertips gave them some appreciation of the quality and intensity of sound and succeeded in allaying a considerable degree of nervous tension. The possibility of developing a meager sense of sound discrimination is not unlikely.

The use of the pure-tone audiometer and the fitting of the wearable vacuum tube hearing aid are the main features that distinguish our program from the Cape May venture of the last war. The new patient is given an individual audiometric examination to determine his loss for sample tones throughout the important portion of his hearing range. Besides confirming a patient's need for rehabilitation, this test acts as a guide in the fitting of a hearing aid — it helps to determine which ear should be fitted and whether or not a bone conduction receiver might be more beneficial than air conduction. It gives assistance in the preliminary selection of an instrument with amplification characteristics suitable for the individual patient. Additional audiometric tests are taken at varying intervals to serve as checks on the first examination and to indicate the stability or trends in his hearing loss. Once it is determined that an aid is to be given, an impression is taken of one or both ears and a lucite ear mold is prepared. Each patient is then given an opportunity to try any or all of nine Council-accepted hearing aids as fitted and adjusted by representatives from each company who play no part in the final selection. After trying these aids under varying conditions in and about the hospital, the patient indicates the two or three instruments which he believes serve him best, and comparative evaluative tests are begun.²

The *pure tone gain* is first measured for each instrument by determining the threshold of hearing with and without the aid, the tones being introduced at controlled intensities through a loud speaker system. Second, the *tolerance limit for pure tones* is determined. Other things being equal, the instrument that handles the higher intensities without discomfort is preferable. From these figures the *dynamic range* of the instrument for the individual concerned is computed. This is of practical value because the patient needs an instrument which will clarify the faint environmental sounds with-

out amplifying the louder sounds to an intolerable level. Tests are then made to determine his *loss for connected speech* in decibels without an aid, and the loss for speech with each of the chosen aids. When the tolerance limit for speech is obtained, the range of speech intensities that each instrument will handle is computed. The greater this range the more practical the aid. The final test is a measure of the auditory resolving power of each instrument obtained by recording the speech threshold and tolerance limits with a superimposed background of noise. With all of these tests the patients find marked differences from aid to aid and the one that is finally selected is the one that gives the best performance throughout the series.

Hughson and Reger² stated that satisfaction with hearing aids in 80 per cent of cases is the utmost that can be expected with the best available refinements in fitting technique. Much of the dissatisfaction that has arisen has resulted from a lack of knowledge of their limitations on the part of the patient. One cannot be fitted with such a complicated mechanism and expect to hear normally. These instruments merely amplify all sounds and transmit them to the damaged ear in a distorted fashion. Adequate adjustment to a mechanical aid requires a cerebral reorientation to the quality and intensities of sound that reaches the brain, and it is becoming increasingly evident that proper instruction will materially enhance a man's benefit from his newly acquired instrument. Our program for auricular training of residual hearing is designed to train the patient in sound discrimination, sound direction, tonal quality — to teach him how to use his hearing aid to maximum advantage. This phase of the work in itself is the subject for a very engrossing dissertation and has been written up by a member of our staff in a comprehensive fashion.⁴

Each patient is obliged to attend one 45-minute lesson in lip-reading every day and has an opportunity to take part in four group-practice lessons. Life situation moving pictures will soon be added to the daily schedule for teaching purposes. Prescribed exercises, recreational activities, occupational therapy and various pedagogical programs are integrated into the schedule under the direction of the Red Cross.

Each man whose speech shows evidence of deterioration is given corrective instruction during the eight weeks period that he is hospitalized. Approximately 50 per cent of admissions have minor speech defects that might attract undesirable attention.

The psychological changes in a deafened individual constitute the major therapeutic problem of the entire scheme of rehabilitation. The basic solution for most of the minor aberrations that are encountered lies in the restoration by the methods presented above, of a patient's ability to perceive conversation. In addition each individual is treated according to his particular need, and an experienced psychologist is now associated with our program to guide us in the applications of basic psychological principles.

The average length of hospitalization for each patient is eight weeks. Most of them are returned to civilian life; a minority go back to duty. The Veterans' Administration has recently publicized an elaborate plan for continuing the rehabilitative measures and instituting vocational training for the sensory handicapped in order to insure "integration into life realistically" and "maximum employability." It is their intention to negotiate contracts with the various governmental and private agencies which are designed to carry on this work. The National Red Cross and the American Society for the Hard-of-Hearing will undoubtedly play a large part in fulfilling our obligations to the aural casualty.

The members of the staff in the three hard-of-hearing centers have been given the right to exploit to the utmost the large volume of patient-material with which they come in contact. With the assistance of a well recognized research organization it is expected that new tests of auditory acuity will be devised, and old tests will be significantly improved. As a consequence, it is anticipated that refinements in the performance characteristics of hearing aids will result.

Auricular training of residual hearing is a relatively new field. It is inevitable that new equipment and techniques of instruction will evolve in our department as time goes on.

We venture to predict that satisfactory tests of lip-reading proficiency using moving pictures as a testing medium will be forthcoming. The possibility of constructing superior psychometric tests designed for the deafened is being explored with a view toward establishing correlations between these tests and a patient's aptitude for adjustment to the limitations of his disability.

Finally, it is an aim of this service to establish a pattern encompassing all phases of treatment for the malady with which we are concerned and to sell that pattern to both the physician and the layman as an example to be followed in the care of the deafened.

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SYMPOSIUM:
THE REHABILITATION OF THE WAR-DEAFENED.

IV.— THE CIVILIAN PROGRAM OF THE
AMERICAN ACADEMY OF OPHTHALMOLOGY
AND OTOLARYNGOLOGY.*

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Soon after the entrance of the United States into World War II, the Committee on the Conservation of Hearing of the American Academy of Ophthalmology and Otolaryngology felt that it was desirable to embark immediately upon a program of rehabilitation for discharged veterans with hearing impairments.

A sub-committee was formed to confer with the Surgeons General and the Director of the Veterans Bureau.

The committee soon learned that service men and women suffering from such disabilities would receive adequate care during their service and before discharge, but it was thought that certain cases would seek private aid and others would continue to need help after discharge from the armed forces. The committee, therefore, decided to formulate a program to reach only those individuals seeking civilian aid and to offer its services in any capacity to the medical branches of the armed forces and to the Veterans Bureau during and after the war.

Members of the committee are aware of the excellent work being done by these groups, and we hope that we may be of material assistance to each other in our common objective of aiding the individual with impaired hearing.

The civilian otologist would be greatly benefited by reading governmental rehabilitation reports on such subjects as: 1. Incidence of various types of aural casualties; 2. efficiency

*Read as part of a Symposium at the Seventy-seventh Annual Meeting of the American Otological Society, Inc., New York, June 6, 1944.

Editor's Note: This ms. received in Laryngoscope Office and accepted for publication, July 1, 1944.

of different types of treatment; 3. techniques of fitting hearing aids; 4. speech-reading problems; and 5. psychological and vocational readjustments. I believe that specific detailed information on these and allied problems will most rapidly facilitate the solution of the many and varied aspects of aural-rehabilitation.

The adult who has experienced a handicapping hearing impairment presents a series of medical, educational, vocational and psychological problems. Effective rehabilitation of the hard-of-hearing must be considered in relation to a complex pattern of readjustment of the individual rather than in terms of unrelated items of reconstruction. The results of treatment may represent a gratifying medical or surgical success but if they do not enable the individual to take his accustomed place in civilian life, the rehabilitation problem still remains unsolved.

It is to be anticipated that many cases will be able to make a reasonably satisfactory adjustment by means of medical treatment, the acquisition of skill in the art of reading lips and the assistance of hearing aids; however, we are equally certain that the most effective application of these combined services will prove woefully inadequate in many instances so that a large number of individuals will find it necessary to make personal, social, vocational and economic adjustments.

As is evident, adequate rehabilitation presents a challenging series of problems. We are forced as never before to give recognition and emphasis to the reconstruction possibilities of lip-reading, instruction in hearing aids, psychological and psychiatric study, vocational training and an efficient follow-up service.

In surveying the situation, the committee realized that up to the present time it has been impossible to carry out such a complete program, even for the present civilian population. There are a few centers in the thickly populated areas that have adequate programs, but this is not true for the country as a whole. There are too few centers with adequate professional staffs and equipment. There are many places where part of this program can be carried out but very few where the entire program of rehabilitation can be solved.

Realizing the tremendous task ahead, the committee began its work with the following program:

1. The preparation of a manual, outlining a program for the rehabilitation of aural casualties.

2. The appointment of state representatives, who will establish when necessary one or more clinics with complete facilities for handling all problems related to the rehabilitation of individuals with impaired hearing.

Our committee has completed and published the manual. Representatives have been appointed, and the following directive has been sent to them:

I. Immediate projects.

A. States in which there is no program at present.

1. Conservation of Hearing Clinics should be started in one or more centers. (Not necessarily connected with universities or colleges).

2. These centers should include:

- a. Detection program.
- b. Accurate diagnostic procedure.
- c. Accepted medical remedial clinics.
- d. Rehabilitation (under medical supervision).
 1. Speech-reading.
 2. Hearing aids.
 3. Psychological.

B. States in which one or more centers have been functioning.

1. Without materially altering these programs their efforts should be correlated with respect to uniformity of procedure and records, with respect to a national program, and to stimulate extension of their activities.

C. Remedial measures should be stressed and methods of convincing all interested groups of their efficacy should be developed.

- D. Complete reports at the end of the first year should be made to the Committee on the Conservation of Hearing.

II. Long range program.

- A. The adequate handling of all hearing impairments.
- B. Uniform methods of procedure and tabulation of findings.
- C. Furnish to Committee on Conservation of Hearing yearly reports of their procedures and findings.
- D. In due time the experience of State Committees will be of sufficient value to be made available to all interested groups.

III. Problems for immediate consideration following organization and establishment of clinics.

- A. Otologic care of discharged veterans with emphasis on rehabilitation.
 - 1. Although the Veterans Administration assumes such responsibility when the veteran is discharged from military service, there may be many individuals who will seek private otological care.

The committee hesitates to give specific direction as to the organization of otologic clinics since local conditions vary so widely in different states and localities; consequently, the following directions should be regarded merely as suggestions to the state representatives of the Academy:

- 1. Become acquainted with existing clinical facilities and state laws regarding handicapped individuals.
- 2. Organize a State Executive Committee for the Conservation of Hearing which may consist of the following:
 - a. Two state representatives of the Academy.
 - b. Two or more other otologists from the state at large.
 - c. State directors of public health, education and public welfare.
 - d. Superintendents of state and local schools for the deaf.

- e. State Legislative Chairmen for the Hard-of-Hearing and Parent-Teachers' Associations.
3. State Executive Committee could later be the governing board or nucleus for a larger State Committee on the Conservation of Hearing, which could be augmented by:
 - a. Additional otologists from various districts of the state.
 - b. Presidents of the League of Women Voters and the State Federation of Women's Clubs.
 - c. State and district presidents of various service clubs.
 - d. Consulting psychologist.
 - e. Speech pathologist.
 - f. Social worker.
 - g. Additional lay members whenever expedient.
4. Promotion of publicity by talks to county and state medical societies, service clubs, parent-teachers' organizations, papers for state and national medical journals, radio programs, motion pictures, etc.
5. Cooperation with the American Society for the Hard-of-Hearing.

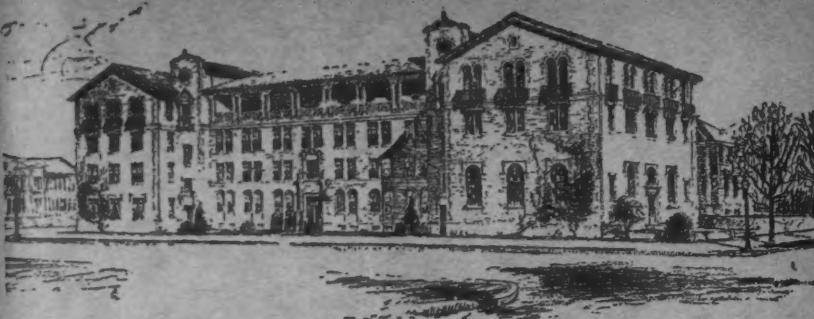
The valuable assistance of lay organizations in the complete rehabilitation of the patient cannot be overemphasized. Patients with hearing losses sufficiently severe and permanent to require hearing aids, or lip-reading instruction, should be encouraged to become members of the local Leagues for the Hard-of-Hearing. These local societies usually provide speech reading lessons, fit hearing aids, vocational opportunity information, and, what is of tremendous psychological importance, social contacts with individuals facing similar handicaps and problems.

Excellent vocational rehabilitation services exist at present in many states. Closer cooperation between members of the state medical societies and the state vocational and social programs appears highly desirable.

In summary, we as civilians have two main objectives:
1. To cooperate whenever possible with the Army, Navy and Veterans Bureau in regard to the rehabilitation of the war-deafened during and after the war. 2. To establish more rehabilitation centers for individuals in civilian life which may eventually include veterans of the war.







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